Attorney Docket No.: 9060-228 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re: Esa Paatero
Serial No.: 10/808,007
Filed: March 24, 2004
For: POWER CONVERSION APPARATUS WITH DC BUS PRECHARGE CIRCUITS AND METHODS OF OPERATING THEREOF

Group Art Unit: 2838
Examiner: Rajnikant B. Patel
Confirmation No.: 5679

Date: March 7, 2008

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Alexandria, VA 22313-1450

APPELLANT'S BRIEF ON APPEAL UNDER 37 C.F.R. § 41.37

Sir:

This Appeal Brief is filed pursuant to the "Notice of Appeal to the Board of Patent Appeals and Interferences" electronically transmitted on January 9, 2007.

Real Party In Interest

The real party in interest is assignee Eaton Electrical Inc., Cleveland, Ohio.

Related Appeals and Interferences

Appellant is not aware of any appeals or interferences that would be affected by the present appeal.

Status of Claims

Claims 1-48 remain pending as of the filing date of this Brief, and stand at least twice rejected. Claims 1-18 and 20-47 have been rejected in non-final office actions dated February 10, 2006, September 8, 2006, January 12, 2007, June 1, 2007 and October 11, 2007. Claim 19 has been amended by an Amendment filed December 7, 2006. Appellant appeals the rejections of Claims 1-48 in the office action mailed October 11, 2007 (hereinafter "Office Action"). The attached Appendix A presents the claims at issue as amended by Appellant's Amendment filed December 7, 2006, which has been entered.

Status of Amendments

The Amendment filed December 7, 2006 has been entered.

Summary of the Claimed Subject Matter

Some embodiments of the present invention according to independent Claim 1 provide a power conversion apparatus including a DC link comprising first and second DC busses and a reference bus (e.g., FIG. 1, reference 140a, 140b, 140c). The apparatus also includes a DC generator circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses (e.g., FIG. 1, reference 20). The apparatus further includes a precharge circuit coupled to the DC link and operative to charge a first capacitance between the first DC bus and the reference bus and to transfer charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus (e.g., FIG. 1, reference 120. *See, e.g.*, specification, p. 6, lines 1-24.

Some embodiments of the present invention according to independent Claim 19 provide a power conversion apparatus including a DC bus (e.g., FIG. 2, reference 140a, 140b), a buck converter circuit coupled to the DC bus and operative to charge a capacitance coupled to the DC bus (e.g., FIG. 2, reference 130') and a boost converter circuit coupled to the DC bus and operative to commence generating a DC voltage on the DC bus from an AC source and/or a DC source after the buck converter circuit precharges the DC bus (e.g., FIG. 2, reference 110). *See, e.g.*, specification, p. 7, line 16 through p. 8 line 16.

Some embodiments of the present invention according to independent Claim 20 provide a power conversion apparatus including a DC link comprising first and second DC busses and a reference bus (e.g., FIG. 2, reference 140a, 140b, 140c), a boost converter circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses from an AC source and/or a DC source (e.g., FIG. 2, reference 110), and a precharge circuit coupled to the DC link and operative to charge a first capacitance between the first DC bus and the reference bus and to transfer charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus (e.g., FIG. 2, reference 130'). *See, e.g.*, specification, p. 7, line 16 through p. 8 line 16.

Some embodiments of the present invention according to independent Claim 25 provide an uninterruptible power supply (UPS) including a DC link comprising first and second DC busses and a reference bus (e.g., FIG. 2, reference 140a, 140b, 140c) and a DC generator circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses from either or both of a first power source and a second power source (e.g., FIG. 2, reference 110, 180). The apparatus further includes a precharge circuit coupled to the DC link and operative to charge a first capacitance between the first DC bus and the reference bus and to transfer charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus (e.g., FIG. 2, reference 130', 110). See, e.g., specification p. 7, line 16 through p. 8, line 16.

Some embodiments of the present invention according to independent Claim 40 provide methods of operating a power converter including a DC link comprising first and second DC busses and a reference bus and a DC generator circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses. The methods include charging a first capacitance between the first DC bus and the reference bus, transferring charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus to charge the second capacitance and then generating the first and second DC voltages on the first and second DC busses using the DC generator circuit. See, e.g., FIG. 2 and specification p. 7, line 16 through p. 8, line 16.

Grounds of Rejection to be Reviewed on Appeal

1. Are Claims 1-48 properly rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,819,576 to Johnson, Jr. (hereinafter "Johnson '576") in view of U.S. Patent No. 6,483,730 to Johnson, Jr. (hereinafter "Johnson '730") (Office Action, p. 2.)?

Argument

I. Introduction

Claims 1-48 stand rejected as allegedly obvious. To establish a *prima facie* case of obviousness under 35 U.S.C. § 103, the prior art reference or references, when combined, must teach or suggest all the recitations of the claims, and there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. M.P.E.P. §2143. As stated in the "Examination Guidelines for Determining Obviousness Under 35 U.S.C. §103 in view of the Supreme Court Decision in *KSR International Co. v. Teleflex Inc.*" (M.P.E.P. §2141), a question regarding whether a claimed invention is obvious under 35 U.S.C. § 103 must include an analysis of the factors set forth in *Graham v. John Deere Co.* (383 U.S. 1, 148 USPQ 459 (1966)), which are described by the Supreme Court in the *KSR* decision to be 1) determining the scope and content of the prior art; 2) ascertaining the differences between the claimed invention and the prior art; and 3) resolving the level of ordinary skill in the pertinent art (hereinafter, the "*John Deere* factors"). The key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious. M.P.E.P. § 2143. A patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art. *KSR Int'l Co. v. Teleflex Inc.*, 550 U. S. 1, 15 (2007). A Court must ask whether the improvement is more than the predictable use of prior art elements according to their established functions. *Id.* at 13. When it is necessary for a Court to look at interrelated teachings of multiple patents, the Court must determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. *Id.* at 14.

II. Claims 1-48 are patentable

Appellant notes that the entirety of the grounds for the rejections of Claims 1-48 is contained within one paragraph on pages 2 and 3 of the Office Action, reproduced in its entirety below:

> Johnson, Jr. (576) discloses claimed subject matters a power conversion apparatus (figure 2 and 3), including DC link comprising first and second bus (figure 3, item 305a and 305b), a reference bus (figure 3, item GND), first and second DC voltages (figure 3, item V1 and V2), an uninterruptible power supply (Abstract, line 105) and a pre charge circuit (figure 3, item 330), an AC source and/or DC source (figure 3, item 10 and 303), a balancer circuit (column 2, line 35-45), an inductor (figure 3, item L1),

> a first and second switches (figure 3, item Q1 and Q2), a third switch (figure 3, item S), a common half-bridge circuit (figure 3, item L1, Q1 and Q3), a rectifier circuit (figure 3, item 310). However Johnson, Jr. (576) does not disclose the utilization technique for a transferring charge from first capacitor to second capacitor, a buck converter and boost converter topology Johnson, Jr. (730) teaches the utilization of the similar technique for a transferring charge from first capacitor to second capacitor (column 4, lines 15-21), a buck converter and boost converter topology (column 9-12, line 1-65). It would have been obvious one having an ordinary skill in the art.

Respectfully, the rejections of Claims 1-48 clearly fail to meet the requirements for a *prima facie* showing of obviousness under 35 U.S.C. §103. Among other things, the Office Action fails to provide any specific indication as to which of Claims 1-48 the items in this listing pertain. It appears that the teachings attributed to Johnson '576 and Johnson '730 refer generally to independent Claims 1, 20, 25 and 40, but the Office Action merely recites a list of items from each reference without any discussion of their specific application to specific claim recitations, or how items from the two references would be combined in the proposed combination. Furthermore, other than a conclusory assertion that "it would have been obvious," the Office Action provides virtually no reasoning regarding a motivation or suggestion to combine Johnson '576 and '730. As discussed above, the key to supporting any rejection under 35 U.S.C. 103 is the clear articulation of the reason(s) why the claimed invention would have been obvious, and the Office Action is completely deficient in this respect.

The Office Action also commits clear errors of fact in its interpretation of the references. For example, the Office Action mistakenly alleges that "item 330" corresponds to the recited "precharge circuit" of Claim 1. The circuit 330 in FIG. 3 of Johnson '576 is a ***battery converter circuit***, and there is no teaching or suggestion in Johnson '576 that it operates as a precharge circuit in the manner recited in the claims. *See* Johnson '576, column 5, lines 43-51. The cited passage from column 4, lines 15-21 of Johnson '730, cited as allegedly teaching "utilization of the similar technique for a transferring charge from first capacitor to second capacitor," states:

> First and second capacitors are rectifyingly coupled to the load to produce respective first and second DC voltages across respective ones of the first and second capacitors from an AC output voltage at the load. The first and second capacitors are selectively coupled to the load through respective third and fourth switches to transfer power between the first and second capacitors and the load.

Contrary to the assertions in the Office Action, there is nothing in this passage teaching or suggesting "the similar technique for a transferring charge from the first capacitor to second capacitor." In fact, this passage has nothing to due with operation of a precharge circuit and says nothing about charge transfers ***between the first and second capacitors***. Accordingly, the Office Action's interpretation of the references is clearly factually erroneous.

The Office Action also commits factual errors regarding the requirements for a *prima facie* showing of obvious with respect to the other independent claims. For example, regarding independent Claim 19, the Office Action concedes that Johnson '576 does not disclose "a buck converter and boost converter topology," but alleges that Johnson '730 teaches "a buck converter and boost converter topology," referring generally to columns 9-12 of Johnson '730. Office Action, p. 3. These passages generally describe a converter that is capable of bucking or boosting an AC output voltage V_{out} with respect to DC voltages V_1 and V_2 (see FIGs. 6-11). In contrast, FIG. 19 recites a particular combination of buck and boost converter circuits that interoperate in a particular manner, i.e., "a boost converter circuit coupled to the DC bus and operative to commence generating a DC voltage on the DC bus from an AC source and/or a DC source after the buck converter circuit precharges the DC bus," which is nowhere to be found in the cited portion of Johnson '730.

In light of the foregoing, Appellant respectfully submits that the Office Action fails to make even a prima facie case of obviousness with respect to Claims 1-48. Appellant also submits that the cited combination of Johnson '576 and Johnson '730 does not disclose or suggest the recitations of independent Claims 1, 19, 20, 25 and 40 and, for at least these reasons, that independent Claims 1, 19, 20, 25 and 40 are patentable, and that dependent Claims 2-18, 21-24, 26-39 and 41-48 are patentable at least by virtue of the patentability of the respective ones of independent Claims 1, 20, 25 and 40 from which they depend.

Appellant further submits that several of the dependent claims are also separately patentable. However, as can be discerned from the discussion above, the Office Action fails to provide any specific indication as to how or where the cited combination of references teaches or suggests the specific recitations of these claims. As such, the Office Action deprives Appellant of any meaningful opportunity to address the separate patentability of these claims with respect to the cited combination of references and, accordingly, Appellant submits that further discussion of grounds for separate patentability of the dependent claims is unnecessary at this time.

IV. Conclusion

In light of the above discussion, Appellant submits that the pending claims are directed to patentable subject matter and, therefore, request reversal of the rejections of those claims and passing of the application to issue.

It is not believed that an extension of time and/or additional fee(s) are required, beyond those that may otherwise be provided for in documents accompanying this paper. In the event, however, that an extension of time is necessary to allow consideration of this paper, such an extension is hereby petitioned for under 37 C.F.R. §1.136(a). Any additional fees believed to be due in connection with this paper may be charged to Deposit Account No. 50-0220.

Respectfully submitted,

Robert M. Meeks
Registration No. 40,723
Attorney for Appellant

Customer No. 20792
Myers Bigel Sibley & Sajovec, P.A.
P. O. Box 37428
Raleigh, North Carolina 27627
Telephone: (919) 854-1400
Facsimile: (919) 854-1401

CERTIFICATION OF TRANSMISSION

I hereby certify that this correspondence is being transmitted via the Office electronic filing system in accordance with § 1.6(a)(4) to the U.S. Patent and Trademark Office on March 7, 2008.

Candi L. Riggs

APPENDIX A
Pending Claims
USSN 10/808,007l
Filed: March 24, 2004

1. (Original) A power conversion apparatus comprising:

a DC link comprising first and second DC busses and a reference bus;

a DC generator circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses; and

a precharge circuit coupled to the DC link and operative to charge a first capacitance between the first DC bus and the reference bus and to transfer charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus.

2. (Original) An apparatus according to Claim 1, wherein the DC generator circuit is operative to commence generation of the first and second DC voltages on the first and second DC busses after the precharge circuit precharges the first and second DC busses.

3. (Original) An apparatus according to Claim 1, wherein the precharge circuit comprises:

a precharge converter circuit operative to charge the first capacitance from an AC source and/or a DC source; and

a balancer circuit operative to transfer charge between the first and second capacitances.

4. (Original) An apparatus according to Claim 3, wherein the balancer circuit is operative to selectively couple the first and second DC busses to the reference bus via an inductor.

5. (Original) An apparatus according to Claim 4, wherein the balancer circuit comprises:

an inductor; and

first and second switches operative to selectively couple respective ones of the first and second DC busses to the inductor.

6. (Original) An apparatus according to Claim 5, further comprising a third switch operative to couple and decouple the inductor to and from the reference bus.

7. (Original) An apparatus according to Claim 3, wherein the DC generator circuit and the balancer circuit include a common half-bridge circuit.

8. (Original) An apparatus according to Claim 7, wherein the common half-bridge circuit is configurable to operate as a rectifier circuit in a first mode of operation and as a balancer circuit in a second mode of operation.

9. (Original) An apparatus according to Claim 1, wherein the precharge circuit is operative to charge the first capacitance to increase a voltage between the first DC bus and the reference bus to a first voltage and to initiate charge transfer to the second capacitance after the voltage between the first DC bus and the reference bus reaches the first voltage.

10. (Original) An apparatus according to Claim 9, wherein the precharge circuit is further operative to terminate charge transfer to the second capacitance after a voltage between the second DC bus and the reference bus reaches a second voltage.

11. (Original) An apparatus according to Claim 10, wherein the DC generator circuit is operative to generate the first and second DC voltages on the first and second DC busses from an AC source, and wherein the second voltage is greater than a peak voltage of the AC source.

12. (Original) An apparatus according to Claim 10, wherein the precharge circuit is further operative to initiate charge transfer from the charged second capacitance to the first capacitance to further boost the voltage between the first DC bus and the reference bus.

13. (Original) An apparatus according to Claim 9, wherein the DC generator circuit is operative to commence generation of DC voltages on the first and second DC busses after the precharge circuit precharges the first and second capacitances.

14. (Original) An apparatus according to Claim 9, wherein the precharge circuit comprises:

a buck converter circuit operative to charge the first capacitance from an AC power source and/or a DC power source;

a balancer circuit operative to transfer charge between the first and second capacitances; and

a control circuit coupled to the buck converter circuit and to the balancer circuit, the control circuit operative to cause the buck converter circuit to charge the first capacitance to increase the voltage between the first DC bus and the reference bus to the first voltage and to cause the balancer circuit to transfer charge from the charged first capacitance to the second capacitance after the voltage between the first DC bus and the reference voltage reaches the first voltage.

15. (Original) An apparatus according to Claim 1, wherein the DC generator circuit comprises a boost converter circuit.

16. (Original) An apparatus according to Claim 1, wherein the DC generator circuit is operative to generate the first and second DC voltages on the first and second DC busses from an AC power source and/or a DC power source.

17. (Original) An apparatus according to Claim 1, wherein the precharge circuit is operative to charge the first capacitance from an AC power source and/or a DC power source.

18. (Original) An apparatus according to Claim 1, further comprising first and second storage capacitors coupled between respective ones of the first and second DC busses and the reference bus, and wherein the first and second capacitances comprise respective ones of the first and second storage capacitors.

19. (Previously Presented) A power conversion apparatus comprising:

a DC bus;

a buck converter circuit coupled to the DC bus and operative to charge a capacitance coupled to the DC bus; and

a boost converter circuit coupled to the DC bus and operative to commence generating a DC voltage on the DC bus from an AC source and/or a DC source after the buck converter circuit precharges the DC bus.

20. (Original) A power conversion apparatus, comprising:

a DC link comprising first and second DC busses and a reference bus;

a boost converter circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses from an AC source and/or a DC source; and

a precharge circuit coupled to the DC link and operative to charge a first capacitance between the first DC bus and the reference bus and to transfer charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus.

21. (Original) An apparatus according to Claim 20, wherein the boost converter circuit is operative to commence generation of the first and second DC voltages on the first and second DC busses after the precharge circuit precharges the first and second DC busses.

22. (Original) An apparatus according to Claim 20, wherein the precharge circuit comprises:

a buck converter circuit operative to charge the first capacitance; and

a balancer circuit operative to transfer charge between the first and second capacitances.

23. (Original) An apparatus according to Claim 22, wherein the boost converter circuit and the balancer circuit include a common half-bridge circuit.

24. (Original) An apparatus according to Claim 23, wherein the common half-bridge circuit is configurable to operate as a boost rectifier circuit in a first mode of operation and as a balancer circuit in a second mode of operation.

25. (Original) An uninterruptible power supply (UPS) comprising:

a DC link comprising first and second DC busses and a reference bus;

a DC generator circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses from either or both of a first power source and a second power source; and

a precharge circuit coupled to the DC link and operative to charge a first capacitance between the first DC bus and the reference bus and to transfer charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus.

26. (Original) A UPS according to Claim 25, wherein the DC generator circuit is operative to commence generation of the first and second DC voltages on the first and second DC busses after the precharge circuit precharges the first and second DC busses.

27. (Original) A UPS according to Claim 25, wherein the precharge circuit comprises:

a precharge converter circuit operative to charge the first capacitance from an AC source and/or a DC source; and

a balancer circuit operative to transfer charge between the first and second capacitances.

28. (Original) A UPS according to Claim 27, wherein the DC generator circuit comprises a boost converter circuit and wherein the precharge converter circuit comprises a buck converter circuit.

29. (Original) A UPS according to Claim 27, wherein the DC generator circuit and the balancer circuit include a common half-bridge circuit.

30. (Original) A UPS according to Claim 29, wherein the common half-bridge circuit is configurable to operate as a rectifier circuit in a first mode of operation and as a balancer circuit in a second mode of operation.

31. (Original) A UPS according to Claim 25, wherein precharge circuit is operative to charge the first capacitance to increase a voltage between the first DC bus and the reference bus to a first voltage and to initiate charge transfer to the second capacitance after the voltage between the first DC bus and the reference bus reaches the first voltage.

32. (Original) A UPS according to Claim 31, wherein the precharge circuit is further operative to terminate charge transfer to the second capacitance after a voltage between the second DC bus and the reference bus reaches a second voltage.

33. (Original) A UPS according to Claim 32, wherein the DC generator circuit is operative to generate the first and second DC voltages on the first and second DC busses from an AC source, and wherein the second voltage is greater than a peak voltage of the AC source.

34. (Original) A UPS according to Claim 32, wherein the precharge circuit is further operative to initiate charge transfer from the charged second capacitance to the first capacitance to further boost the voltage between the first DC bus and the reference bus.

35. (Original) A UPS according to Claim 25, wherein the precharge circuit is operative to charge the first capacitance from the first power source and/or the second power source.

36. (Original) A UPS according to Claim 25, wherein the first power source comprises an AC power source and wherein the second power source comprises a DC power source.

37. (Original) A UPS according to Claim 36, wherein the DC power source comprises a battery.

38. (Original) A UPS according to Claim 25, further comprising first and second storage capacitors coupled between respective ones of the first and second DC busses and the reference bus, and wherein the first and second capacitances comprise respective ones of the first and second storage capacitors.

39. (Original) A UPS according to Claim 25, further comprising a DC/AC converter circuit coupled to the DC link and operative to generate an AC voltage from the first and second DC voltages.

40. (Original) A method of operating a power converter including a DC link comprising first and second DC busses and a reference bus and a DC generator circuit coupled to the DC link and operative to generate first and second DC voltages with respect to the reference bus on respective ones of the first and second DC busses, the method comprising:

charging a first capacitance between the first DC bus and the reference bus;

transferring charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus to charge the second capacitance; and then

generating the first and second DC voltages on the first and second DC busses using the DC generator circuit.

41. (Original) A method according to Claim 40:

wherein charging a first capacitance comprises charging the first capacitance using a buck converter circuit coupled to an AC source and/or a DC source; and

wherein transferring charge comprises transferring charge using a balancer circuit.

42. (Original) A method according to Claim 41, wherein the DC generator circuit and the balancer circuit include a common half-bridge circuit.

43. (Original) A method according to Claim 42:

wherein transferring charge transferring charge from the charged first capacitance to the second capacitance using a balancer circuit comprises transferring charge from the charged first capacitance using the common half-bridge circuit as a balancer circuit; and

wherein generating the first and second DC voltages on the first and second DC busses using the DC generator circuit comprises generating the first and second DC voltages on the first and second DC busses using the common half-bridge circuit as a rectifier circuit.

44. (Original) A method according to Claim 40:

wherein charging the first capacitance comprises charging the first capacitance to increase a voltage between the first DC bus and the reference bus to a first voltage; and

wherein transferring charge from the charged first capacitance to a second capacitance between the second DC bus and the reference bus to charge the second capacitance comprises initiating charge transfer from the charged first capacitance to the second capacitance after the voltage between the first DC bus and the reference bus reaches the first voltage.

45. (Original) A method according to Claim 44, further comprising terminating charge transfer from the first capacitance to the second capacitance after a voltage between the second DC bus and the reference bus reaches a second voltage.

46. (Original) A method according to Claim 45, wherein generating the first and second DC voltages on the first and second DC busses using the DC generator circuit comprises generating the first and second DC voltages on the first and second DC busses from an AC source, and wherein the second voltage is greater than a peak voltage of the AC source.

47. (Original) A method according to Claim 46, wherein generating the first and second DC voltages on the first and second DC busses using the DC generator circuit is preceded by transferring charge from the charged second capacitance to the first capacitance to further boost the voltage between the first DC bus and the reference bus.

48. (Previously Presented) A UPS comprising the power conversion apparatus of Claim 1, wherein the DC generator circuit is operative to generate the first and second DC voltages from either or both of a first power source and a second power source.

APPENDIX B – EVIDENCE APPENDIX

(NONE)

APPENDIX C – RELATED PROCEEDINGS

(NONE)